

**WHAT IS CLAIMED IS:**

1. A coating formulation for a reactive dye layer for a limited-play optical storage medium, said formulation comprising:
  - (a) at least one polymeric polyhydroxy compound
  - (b) at least one carrier; and
  - (c) at least one reactive material.
2. The coating formulation in accordance with claim 1, wherein the polymeric polyhydroxy compound is selected from the group consisting of polyhydroxystyrene homopolymer, polyhydroxystyrene copolymers, and cellulose derivatives.
3. The coating formulation in accordance with claim 2 wherein said polyhydroxystyrene copolymer is prepared by polymerizing a 4-hydroxystyrene derivative with at least one olefin co-monomer.
4. The coating formulation in accordance with claim 3 wherein said olefin co-monomer is selected from the group consisting of methyl methacrylate, 2-hydroxyethyl methacrylate, methyl acrylate, ethyl acrylate, dimethyl fumarate, dimethyl maleate, maleic anhydride, acrylonitrile, butadiene, isoprene, styrene, ethylene, and tetrafluoroethylene.
5. The coating formulation in accordance with claim 2 wherein said polyhydroxystyrene copolymer is a poly(hydroxystyrene-co-methyl methacrylate).
6. The coating formulation in accordance with claim 2 wherein said polyhydroxystyrene homopolymer is a branched polyhydroxystyrene.
7. The coating formulation in accordance with claim 2 wherein said cellulose derivative is selected from the group consisting of cellulose, cellulose acetate, cellulose acetate butyrate, cellulose propionate, cellulose triacetate, ethyl cellulose, hydroxybutyl methyl cellulose, hydroxypropyl cellulose, hydroxypropyl methyl cellulose, and methyl cellulose.

8. The coating formulation in accordance with claim 1, wherein said reactive material selected from the group consisting of oxygen sensitive leuco methylene blue, brilliant cresyl blue, basic blue 3, toluidine 0, combinations comprising at least one of the foregoing reactive materials, and protected forms of any of the foregoing reactive materials.

9. The coating formulation in accordance with claim 1, wherein said carrier comprises poly(methyl methacrylate) and said reactive material comprises leuco methylene blue.

10. The coating formulation in accordance with claim 1, wherein said reactive material is present in an amount corresponding to between about 1 weight % and about 10 weight %, based upon a total weight of said coating formulation.

11. The coating formulation in accordance with claim 10, wherein said reactive material is present in an amount corresponding to between about 4 weight % and about 7 weight %, based upon the total weight of said coating formulation.

12. The coating formulation in accordance with claim 11, wherein said reactive material is present in an amount corresponding to between about 4 weight % and about 6 weight %, based upon the total weight of said coating formulation..

13. The coating formulation in accordance with claim 1, wherein said carrier is selected from the group consisting of thermoplastic acrylic polymers, polyester resins, epoxy resins, polythiolenes, UV curable organic resins, polyurethanes, thermosettable acrylic polymers, alkyds, vinyl resins, and reaction products and combinations comprising at least one of the foregoing carriers.

14. The coating formulation in accordance with claim 13, wherein said carrier comprises a thermoplastic acrylic polymer.

15. The coating formulation in accordance with claim 14, wherein said thermoplastic acrylic polymer comprises poly(methyl methacrylate/methacrylic acid).

16. The coating formulation in accordance with claim 1, wherein said carrier has an inherent viscosity less than about  $0.300 \text{ cm}^3 \text{ g}^{-1}$ .

17. The coating formulation in accordance with claim 16, wherein said carrier has an inherent viscosity less than about  $0.250 \text{ cm}^3 \text{ g}^{-1}$ .

18. The coating formulation in accordance with claim 17, wherein said carrier has an inherent viscosity less than about  $0.200 \text{ cm}^3 \text{ g}^{-1}$ .

19. The coating formulation in accordance with claim 1, wherein said polymeric polyhydroxy compound is present in an amount corresponding to between about 1 weight % and about 20 weight %, based upon the total weight of said formulation.

20. The coating formulation in accordance with claim 19, wherein said polymeric polyhydroxy compound is present in a range between about 3 weight % and about 15 weight %, based upon the total weight of said coating formulation.

21. The coating formulation in accordance with claim 20, wherein said polymeric polyhydroxy compound is present in a range between about 5 weight % and about 10 weight %, based upon the total weight of said coating formulation.

22. A coating formulation for a reactive dye layer for a limited-play optical storage medium, said formulation comprising:

- (a) a polyhydroxystyrene homopolymer;
- (b) a carrier comprising poly(methyl methacrylate/methacrylic acid) having an inherent viscosity of less than about  $0.200 \text{ cm}^3 \text{ g}^{-1}$ , and polymethylmethacrylate; and
- (c) a reactive material comprising N-(triisopropylsilyloxycarbonyl) leuco methylene blue;

said polyhydroxystyrene homopolymer being present in a an amount corresponding to between about 5 weight % and about 10 weight % of a total weight of the reactive layer.

23. A limited play optical storage medium for data, comprising:

- a) a first optically transparent substrate;
- b) a reflective layer;
- c) a data layer disposed between said substrate and said reflective layer;
- d) a reactive layer comprising
  - (i) at least one polymeric polyhydroxy compound,
  - (ii) at least one carrier, and
  - (iii) at least one reactive material; and
- e) a second substrate.

24. The limited play optical storage medium in accordance with claim 23, wherein said polymeric polyhydroxy compound comprises polyhydroxystyrene homopolymer.

25. The limited play optical storage medium in accordance with claim 23, wherein said polymeric polyhydroxy compound comprises poly(hydroxystyrene-co-methyl methacrylate).

26. The limited play optical storage medium in accordance with claim 23, wherein said first substrate is plastic.

27. The limited play optical storage medium in accordance with claim 26, wherein said plastic comprises at least one thermoplastic having a glass transition temperature of about 100°C or greater.

28. The limited play optical storage medium in accordance with claim 27, wherein said thermoplastic is selected from the group consisting of polyvinyl chloride, polyolefins, polyesters, polyamides, polysulfones, polyimides, polyetherimides, polyether sulfones, polyphenylene sulfides, polyether ketones, polyether ether ketones, ABS resins, polystyrenes, polybutadiene, polyacrylates, polyacrylonitrile, polyacetals, polycarbonates, polyphenylene ethers, ethylene-vinyl acetate copolymers, polyvinyl acetate, liquid crystal polymers, ethylene-tetrafluoroethylene copolymer, aromatic polyesters, polyvinyl fluoride, polyvinylidene fluoride, polyvinylidene chloride, tetrafluoroethylene, and mixtures, copolymers, reaction products, and composites comprising at least one of the foregoing thermoplastics.

29. The limited play optical storage medium in accordance with claim 28, wherein said thermoplastic comprises polycarbonate.

30. The limited play optical storage medium in accordance with claim 23, wherein said reactive material is selected from the group consisting of oxygen sensitive leuco methylene blue, reduced forms of methylene blue, brilliant cresyl blue, basic blue 3, toluidine 0, and combinations comprising at least one of the foregoing reactive materials.

31. The limited play optical storage medium in accordance with claim 30, wherein said reactive layer further comprises poly(methyl methacrylate) and leuco methylene blue.

32. The limited play optical storage medium in accordance with claim 23, wherein said reactive material is present in a range between about 1 weight % and about 10 weight %, based upon a total weight of said reactive layer.

33. The limited play optical storage medium in accordance with claim 32, wherein said reactive material is present in a range between about 4 weight % and about 7 weight %, based upon the total weight of said reactive layer.

34. The limited play optical storage medium in accordance with claim 33, wherein said reactive material is present in a range between about 4 weight % and about 6 weight %, based upon the total weight of said reactive layer.

35. The limited play optical storage medium in accordance with claim 23, wherein said carrier is selected from the group consisting of thermoplastic acrylic polymers, polyester resins, epoxy resins, polythiolenes, UV curable organic resins, polyurethanes, thermosettable acrylic polymers, alkyds, vinyl resins, and reaction products and combinations comprising at least one of the foregoing carriers.

36. The limited play optical storage medium in accordance with claim 35, wherein said carrier comprises a thermoplastic acrylic polymer.

37. The limited play optical storage medium in accordance with claim 36, wherein said thermoplastic acrylic polymer comprises poly(methyl methacrylate/methacrylic acid) copolymer.

38. The limited play optical storage medium in accordance with claim 23, wherein said carrier has an inherent viscosity less than about  $0.300 \text{ cm}^3 \text{ g}^{-1}$ .

39. The limited play optical storage medium in accordance with claim 38, wherein said carrier has an inherent viscosity less than about  $0.250 \text{ cm}^3 \text{ g}^{-1}$ .

40. The limited play optical storage medium in accordance with claim 39, wherein said carrier has an inherent viscosity less than about  $0.200 \text{ cm}^3 \text{ g}^{-1}$ .

41. The limited play optical storage medium in accordance with claim 23, wherein said polymeric polyhydroxy compound is present in an amount corresponding to between about 1 weight % and about 20 weight % of a total weight of the reactive layer.

42. The limited play optical storage medium in accordance with claim 41, wherein said polymeric polyhydroxy compound is present in an amount corresponding to between about 3 weight % and about 15 weight % of the total weight of the reactive layer.

43. The limited play optical storage medium in accordance with claim 42, wherein said polymeric polyhydroxy compound is present in an amount corresponding to between about 5 weight % and about 10 weight % of the total weight of the reactive layer.

44. The limited play optical storage medium in accordance with claim 23, wherein the reflective layer comprises a metal.

45. The limited play optical storage medium in accordance with claim 44, wherein the metal is selected from the group consisting of aluminum, silver, gold, titanium, alloys, or combinations thereof.

46. The limited play optical storage medium in accordance with claim 45, wherein the metal comprises aluminum.

47. A limited play optical storage medium for data, comprising:

- a) an optically transparent polycarbonate;
- b) a reflective layer;
- c) a data layer disposed between said substrate and said reflective layer;
- d) a second substrate; and
- e) a reactive layer disposed between said reflective layer and said second substrate, said reactive layer comprising a polyhydroxystyrene homopolymer; a poly(methyl methacrylate methacrylic acid) copolymer, polymethylmethacrylate homopolymer, and leuco methylene blue; said copolymer having an inherent viscosity of less than about  $0.200 \text{ cm}^3 \text{ g}^{-1}$ .

48. An adhesive formulation for a reactive dye layer for a limited-play optical storage medium, said formulation comprising:

- a) at least one polymeric polyhydroxy compound

- b) at least one curable acrylate monomer; and
- c) at least one reactive material.

49. The adhesive formulation in accordance with claim 48, wherein the polymeric polyhydroxy compound is selected from the group consisting of polyhydroxystyrene homopolymer, polyhydroxystyrene copolymers, and cellulose derivatives.

50. The adhesive formulation in accordance with claim 49 wherein said polyhydroxystyrene copolymer is prepared by polymerizing a 4-hydroxystyrene derivative with at least one olefin co-monomer.

51. The adhesive formulation in accordance with claim 50 wherein said olefin co-monomer is selected from the group consisting of methyl methacrylate, 2-hydroxyethyl methacrylate, methyl acrylate, ethyl acrylate, dimethyl fumarate, dimethyl maleate, maleic anhydride, acrylonitrile, butadiene, isoprene, styrene, ethylene, and tetrafluoroethylene.

52. The adhesive formulation in accordance with claim 49 wherein said polyhydroxystyrene copolymer is a poly(hydroxystyrene-co-methyl methacrylate).

53. The adhesive formulation in accordance with claim 49 wherein said polyhydroxystyrene homopolymer is a branched polyhydroxystyrene.

54. The adhesive formulation in accordance with claim 49 wherein said cellulose derivative is selected from the group consisting of cellulose, cellulose acetate, cellulose acetate butyrate, cellulose propionate, cellulose triacetate, ethyl cellulose, hydroxybutyl methyl cellulose, hydroxypropyl cellulose, hydroxypropyl methyl cellulose, and methyl cellulose.

55. The adhesive formulation in accordance with claim 48, wherein said reactive material selected from the group consisting of oxygen sensitive leuco methylene blue, brilliant cresyl blue, basic blue 3, toluidine 0, combinations



comprising at least one of the foregoing reactive materials, and protected forms of any of the foregoing reactive materials.

56. The adhesive formulation of claim 55 wherein said protected form is N-(triisopropylsilyloxycarbonyl) leuco methylene blue.

57. The adhesive formulation in accordance with claim 48, wherein said reactive material is present in an amount corresponding to between about 0.5 weight % and about 10 weight %, based upon a total weight of said adhesive formulation.

58. The adhesive formulation in accordance with claim 57, wherein said reactive material is present in an amount corresponding to between about 1 weight % and about 7 weight %, based upon the total weight of said adhesive formulation.

59. The adhesive formulation in accordance with claim 58, wherein said reactive material is present in an amount corresponding to between about 1 weight % and about 4 weight %, based upon the total weight of said adhesive formulation.

60. The adhesive formulation in accordance with claim 48, wherein said curable acrylate monomer is selected from the group consisting of polyfunctional acrylates and monoacrylates.

61. The adhesive formulation in accordance with claim 60, wherein said polyfunctional acrylate comprises trimethylolpropane triacrylate, and said mono acrylate comprises phenoxyethyl acrylate.

62. The adhesive formulation in accordance with claim 61 further comprising Sn (II) 2-ethylhexanoate.

63. The adhesive formulation in accordance with claim 48 having a viscosity in a range between about 200 and about 600 cP at 25°C.

64. A limited play optical storage medium for data, comprising:

a) a first optically transparent substrate;

- b) a reflective layer;
- c) a data layer disposed between said substrate and said reflective layer;
- d) a reactive layer prepared from an adhesive formulation comprising
  - (i) at least one polymeric polyhydroxy compound,
  - (ii) at least one curable acrylate monomer; and
  - (iii) at least one reactive material; and
- a) a second substrate.

65. The limited play optical storage medium in accordance with claim 24, wherein said polymeric polyhydroxy compound comprises polyhydroxystyrene homopolymer.